Form PTO-1390 (Rev. 12-29-99) US DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NO.
H 4186 PCT/US

U.S. APPLICATION NO. (if known see 37 CFR 1.5) 10/030267

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/EP00/05805	**June 23, 2000**	**July 1, 1999**

TITLE OF INVENTION
METHOD AND SYSTEM FOR THE PRODUCTION OF POLYURETHANE HOT-MELT TYPE ADHESIVES

APPLICANT(S) FOR DO/EO/US
Hans-Peter KOHLSTADT and Andrew NIXON

Applicant herewith submits to the United States Designated/Elected Office (EO/DO/US) the following items and other information:

1. ■ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. □ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. □ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39 (1).
4. ■ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ■ A copy of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. □ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ■ has been transmitted by the International Bureau.
   c. □ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ■ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ■ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. □ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. □ have been transmitted by the International Bureau.
   c. □ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ■ have not been made and will not be made.
8. □ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ■ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. □ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. □ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. □ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ■ A FIRST preliminary amendment
    □ A SECOND or SUBSEQUENT preliminary amendment.
14. □ A substitute specification.
15. □ A change of power of attorney and/or address letter.
16. ■ Other items or information:
    International Search Report (With Information Disclosure Citation and References)
    Drawings - 4 sheets

"Express Mail" mailing label number EL 615775043 US

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U.S. Application No. (If known, see 37 CFR 1.5) 10/030267	INTERNATIONAL APPLICATION NO. PCT/EP00/05805	ATTORNEY'S DOCKET NUMBER H 4186 PCT/US

17. ■ The following fees are submitted:	CALCULATIONS	PTO USE ONLY
BASIC NATIONAL FEE (37 CFR 1.492(a)(1)-(5)): Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO.....$1,000.00		
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO.....$860.00		
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37CFR 1.445(a)(2)) paid to USPTO $710.00		
International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4)		
International preliminary examination fee paid to USPTO (37CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4).....		
ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 890	
Surcharge of $130.00 for furnishing the oath or declaration later than ▪ 20 ▪ 30 months from the earliest claimed priority date 37 (CFR 1.492(e)).	$ 0	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total Claims	15 - 20 =	0	0 X $18.00	$ 0	
Independent Claims	2 - 3 =	0	0 X $80.00	$ 0	
Multiple dependent claims (s)(if applicable)		0	+ $270.00	$ 0	
TOTAL OF ABOVE CALCULATIONS =				$ 890	
Reduction of ½ for filing by small entity, if applicable. A Small Entity Statement must also be filed. (Note 37 CFR 1.9, 1.27, 1.28).				$ 0	
SUBTOTAL =				$ 890	
Processing fee of $130.00 for furnishing the English translation later the ▪ 20 ▪ 30 months from the earliest claimed priority date (37 CFR 1.492(f)). +				$ 0	
TOTAL NATIONAL FEE =				$ 890	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). $40.00 per property				$ 0	
TOTAL FEES ENCLOSED				$ 890	
				Amount to be: refunded:	$----------
				charged:	$ 890.00

a. ▪ A check in the amount of $_____ to cover the above fees is enclosed.

b. ■ Please charge my Deposit Account No. 01-1250 in the amount of $ 890.00 to cover the above fees. A triplicate copy of this sheet is enclosed. Order No. 01-0920 .

c. ■ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 01-1250 . A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137 (a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO: Henkel Corporation, Law Dept.
2500 Renaissance Blvd., Suite 200
Gulph Mills, PA 19406

SIGNATURE:

Glenn E. J. Murphy
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33,539
REGISTRATION NUMBER

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PATENT
Docket H 4186 PCT/US

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Re: PCT/EP00/05805

International Filing Date:	June 23, 2000
Priority Date:	July 1, 1999
Applicant:	KOHLSTADT, et al.
Title:	METHOD AND SYSTEM FOR THE PRODUCTION OF POLYURETHANE HOT-MELT TYPE ADHESIVES

PRELIMINARY AMENDMENT

Assistant Commissioner of Patents
Washington, DC 20231

Please enter the amendments below before examining this application on the merits:

IN THE SPECIFICATION:

On page 1, insert below the title:

--CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a U.S. National Stage application under 35 U.S.C. § 371 of International Application No. PCT/EP00/05805, claiming priority under 35 U.S.C. §§ 119 and 365 of PCT/EP00/05805, filed June 23, 2000, in the European Patent Office and DE 199 29 820.3, filed on July 1, 1999, in the German Patent Office.--

Preliminary Amendment of US National Stage for International Application PCT/EP00/05805 filed June 23, 2000

On page 2, insert between lines 21 and 22 the heading --DESCRIPTION OF THE INVENTION--.

ABSTRACT:

Please add the attached abstract to the application as a separate page following the claims.

IN THE CLAIMS:

Please cancel claims 1-12 without prejudice, and add new claims 13-27:

13. A process for the production of polyurethane hot-melt adhesives from components comprising at least an isocyanate component A and a component B containing a group that is reactive to isocyanate groups, the process comprising the steps of separately dosing and melting components A and B and subsequently mixing the melted components A and B, whereby the mixed components A and B react to form the polyurethane adhesive.

14. The process of claim 13, comprising extruding one or both of the separated components A and B prior to mixing.

15. The process of claim 13, wherein the separated components are separately melted at the same time.

16. The process of claim 14, wherein the one or both of the separated components A and B are heated during extrusion.

17. The process of claim 13, comprising mixing the melted

components A and B with a static mixer.

18. The process of claim 14, wherein the components A and B are mixed immediately after any extrusion.

19. The process of claim 13, wherein an additional component (C) is added during mixing.

20. The process of claim 13, wherein component A comprises a monofunctional, polyfunctional, or blocked isocyanate.

21. The process claim 13, wherein component B comprises a polyol.

22. The process claim 19, wherein component C comprises one or more of an accelerator, a thixotropicizing agent, a foam-generating additive, a stabilizer, a dye, a pigment, or a molecular sieve.

23. The process of claim 19, wherein component C is added when mixing of components A and B begins.

24. The process of claim 13, wherein the components A and B are heated during mixing.

25. The process of claim 13, comprising applying the adhesive to a substrate to be bonded immediately after the adhesive is formed.

26. The process of claim 25, comprising dosing the adhesive before application to the substrate.

27. An apparatus for continuous production of a polyurethane hot-melt adhesive from components comprising at least an isocyanate component A and a component B containing a group that is reactive to isocyanate groups, the apparatus comprising separate extruders provided for separate extrusion of components A and B, each extruder having an outlet connected to an inlet of a mixer provided for mixing of the separately extruded components A and B.

REMARKS

Applicants cancel claims 1-12 without prejudice and enter new claims claims 13-27. The subject matter of the new claims is described the specification at page 2, lines 22-26, page 3, line 18 to page 4, line 6, and page 4, line 11 to page 5, line 3, as well as in the original claims. The specification has been amended to include a cross-reference to related applications and headings appropriate to U.S. practice. No new matter has been added.

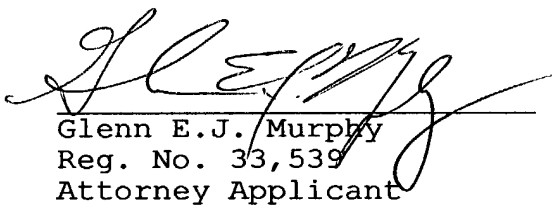
The new claims better claim the full literal and equivalent scope and breadth of subject matter disclosed in the application, notwithstanding applicants' belief that the original claims, drafted for examination in the German and European Patent Offices, would have been allowable but for minor matters of form permitted in German or European practice but objected to in the U.S.P.T.O. The new claims find support in the application independent of the original claims and therefore are not believed to constitute narrowing amendments to the original claims within the

Preliminary Amendment of US National Stage for International Application PCT/EP00/05805 filed June 23, 2000

holding of Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co., No. 95-1066 (Fed. Cir. Nov. 29, 2000).

Applicants respectfully request entry of this Amendment and examination of the application. If any fees are due to enter this paper that have not been accounted for, please charge Deposit Account No. 01-1250.

Respectfully submitted,



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Preliminary Amendment of US National Stage for International Application PCT/EP00/05805 filed June 23, 2000

ABSTRACT

Polyurethane hot-melt type adhesives are produced from an isocyanate (first constitutent A) and at least one second constituent (B) known per se. Both constituents (A, B) are extruded separately and melted, whereupon they are mixed and reacted with each other. The invention provides a plurality of advantages over prior art.

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PATENT
Docket H 4186

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: Application of **Kohlstadt et al.**

International Application No. PCT/EP00/05805
International Filing Date: June 23, 2000

Serial No. 10/030,267 **Examiner:** To be assigned
Filed: To be assigned **Art Unit:** To be assigned

TITLE: METHOD AND SYSTEM FOR THE PRODUCTION OF POLYURETHANE HOT-MELT TYPE ADHESIVES

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Commissioner for Patents
Washington, DC 20231

Attn: DO/EO/US

SUPPLEMENTAL PRELIMINARY AMENDMENT

Further to the preliminary amendment filed January 2, 2002, please amend the application as follows:

IN THE CLAIMS:

19. (amended) A process for the production of polyurethane hot-melt adhesives from components comprising at least an isocyanate component A and a component B containing a group that is reactive to isocyanate groups, the process comprising the steps of separately dosing and melting components A and B and subsequently mixing the melted components A and B, whereby the mixed components A and B react to form the polyurethane adhesive.

20. (amended) The process of claim 19, comprising

extruding one or both of the separated components A and B prior to mixing.

21. (amended) The process of claim 19, wherein the separated components are separately melted at the same time.

22. (amended) The process of claim 20, wherein the one or both of the separated components A and B are heated during extrusion.

23. (amended) The process of claim 19, comprising mixing the melted components A and B with a static mixer.

24. (amended) The process of claim 20, wherein the components A and B are mixed immediately after any extrusion.

25. (amended) The process of claim 19, wherein an additional component (C) is added during mixing.

26. (amended) The process of claim 19, wherein component A comprises a monofunctional, polyfunctional, or blocked isocyanate.

27. (amended) The process of claim 19, wherein component B comprises a polyol.

28. (amended) The process of claim 25, wherein component C comprises one or more of an accelerator, a thixotropicizing agent, a foam-generating additive, a stabilizer, a dye, a pigment, or a molecular sieve.

29. (amended) The process of claim 25, wherein component C is added when mixing of components A and B begins.

30. (amended) The process of claim 19, wherein the components A and B are heated during mixing.

31. (amended) The process of claim 19, comprising applying the adhesive to a substrate to be bonded immediately after the adhesive is formed.

32. (amended) The process of claim 31, comprising dosing the adhesive before application to the substrate.

33. (amended) An apparatus for continuous production of a polyurethane hot-melt adhesive from components comprising at least an isocyanate component A and a component B containing a group that is reactive to isocyanate groups, the apparatus comprising separate extruders provided for separate extrusion of components A and B, each extruder having an outlet connected to an inlet of a mixer provided for mixing of the separately extruded components A and B.

Please add new claims 34-38:

34. The apparatus of claim 33, wherein the extruders are heatable.

35. The apparatus of claim 33, wherein the mixer is a static mixer.

36. The apparatus of claim 33, wherein the mixer is

heatable.

37. The apparatus of claim 33, wherein the outlets of the extruders are connected directly or by heated pipes to the inlet of the static mixer.

38. The apparatus of claim 33, wherein the outlet of the mixer is connected to the inlet of an adhesives application through a dosing apparatus.

REMARKS

Claims 13-27 have been renumbered as claims 19-33, and new claims 34-38 have been added based on claims 13-18 of the application as originally filed. No new matter has been added. Should any fees be due that have not been accounted for in order to have this paper entered and examination of the application continued, including any fess for extensions of time under 37 C.F.R. § 1.136, please charge Deposit Account No. 01-1250.

Respectfully submitted,

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CLAIMS AMENDED JUNE 28, 2002, SHOWING AMENDMENTS

19[13]. A process for the production of polyurethane hot-melt adhesives from components comprising at least an isocyanate component A and a component B containing a group that is reactive to isocyanate groups, the process comprising the steps of separately dosing and melting components A and B and subsequently mixing the melted components A and B, whereby the mixed components A and B react to form the polyurethane adhesive.

20[14]. The process of claim 19[13], comprising extruding one or both of the separated components A and B prior to mixing.

21[15]. The process of claim 19[13], wherein the separated components are separately melted at the same time.

22[16]. The process of claim 20[14], wherein the one or both of the separated components A and B are heated during extrusion.

23[17]. The process of claim 19[13], comprising mixing the melted components A and B with a static mixer.

24[18]. The process of claim 20[14], wherein the components A and B are mixed immediately after any extrusion.

25[19]. The process of claim 19[13], wherein an additional component (C) is added during mixing.

26[20]. The process of claim 19[13], wherein component A comprises a monofunctional, polyfunctional, or blocked isocyanate.

27[21]. The process of claim 19[13], wherein component B comprises a polyol.

28[22]. The process of claim 25[19], wherein component C comprises one or more of an accelerator, a thixotropicizing agent, a foam-generating additive, a stabilizer, a dye, a pigment, or a molecular sieve.

29[23]. The process of claim 25[19], wherein component C is added when mixing of components A and B begins.

30[24]. The process of claim 19[13], wherein the components A and B are heated during mixing.

31[25]. The process of claim 19[13], comprising applying the adhesive to a substrate to be bonded immediately after the adhesive is formed.

32[26]. The process of claim 31[25], comprising dosing the adhesive before application to the substrate.

33[27]. An apparatus for continuous production of a polyurethane hot-melt adhesive from components comprising at least an isocyanate component A and a component B containing a group that is reactive to isocyanate groups, the apparatus comprising separate extruders provided for separate extrusion of components A and B, each extruder

having an outlet connected to an inlet of a mixer provided for mixing of the separately extruded components A and B.

Method and System for the Production of Polyurethane Hot-melt Type Adhesives

This invention relates to a process for the production, more particularly the continuous production, of polyurethane hotmelt adhesives from an isocyanate (first component A) and at least a second component B known per se.

Hotmelt adhesives, also known as hotmelts, are based inter alia on polyurethanes, are applied in the molten state and set particularly quickly on subsequent cooling. Polyurethanes are adhesive systems specifically composed of polyetherdiols/polyester diols (component B) and diisocyanates. The highly variable hardening of polyurethane adhesives is attributable to a second diol component or to atmospheric moisture. Polyurethanes form high-strength, elastic bonds which are capable of withstanding dynamic loads and changes in temperature.

The process mentioned above is known from a prospectus of Reinhard Düspohl Maschinenbau GmbH which describes a process for the production and immediate application of polyurethane hotmelt adhesives. Granules of the two components A and B are delivered to a mixing zone from two separate hoppers by separately driven metering screws. From the mixing zone, the granules pass into an extruder where they are heated to softening point by compression and frictional heat and processed to a homogeneous adhesive composition. The extruder may be followed by application systems for hotmelt adhesive.

However, depite its undoubted advantages, this process is also attended by a number of disadvantages. The melting temperature is applied solely by the drive energy of the extruder. Accordingly, subsequent heating or cooling is necessary in order to obtain the required processing temperatures and viscosities. To this end, the adhesive has to be brought

to the processing temperature in intermediate tanks which have to be blanketed with inert gas to prevent premature hardening of the adhesive. The cleaning of the intermediate tank with a special cleaner is another disadvantage.

After each stoppage, the machine, more particularly the extruder, has to be cleaned. The isocyanate constituents present in the machine have to be completely neutralized, i.e. reacted off, and removed.

Any water present in component B leads to a chemical reaction with the isocyanate during which carbon dioxide is formed and leads to foaming. In addition, amines by which crosslinking of the adhesive is accelerated, possibly undesirably, are also formed.

Further disadvantages include the high energy costs and the significant losses of adhesive used to "rinse" the machine and the relatively long dwell times of the adhesive mixtures at elevated temperatures. The relatively large amount of adhesive in the machine is also unfavorable. In addition, modified adhesive systems, for example accelerated, thixotropicizing or foaming systems, can only be produced and processed to a limited extent, if at all.

Accordingly, the problem addressed by the present invention was to avoid the above-mentioned disadvantages in the process mentioned at the beginning.

According to the invention, the solution to this problem for the process mentioned at the beginning is characterized in that the two components (A,B) are dosed and transported, preferably extruded, and melted, more particularly at the same time, separately from one another and only then are mixed and allowed to react.

In this way, improved temperature control is achieved during the melting of components A and B in the separate extruders.

The already melted components A and B can be mixed considerably more effectively. There is no longer any need for an intermediate tank to

bring the adhesive mixture to the required processing temperature. No adhesive at all is present in the extruders, only the components required for producing the adhesive. These components only react with one another in the mixer. There is no need to use inert gas. In the event of an interruption in the process, only the mixer and not the extruder need be cleaned, resulting in smaller losses of adhesive than in the prior art. Should the adhesive harden in the machine, only the mixer and not the extruder(s) need be replaced so that the break in operation is minor compared with the known process. Considerably smaller quantities of prepared adhesive are present in the machine and the exposure of the adhesive to heat before it is processed is considerably less. Relatively constant viscosities and consistencies are achieved. Finally, modified adhesive systems in particular, for example non-accelerated to highly accelerated, non-foaming to high-foaming and/or non-thixotropicizing to highly thixotropicizing systems, can also be produced. Another advantage is that water present in component B evaporates before this component comes into contact with the isocyanate.

In another embodiment of the invention, the components (A,B) are additionally heated during extrusion to enable the desired adhesive temperature to be adjusted as required.

In one advantageous embodiment of the invention, a static mixer is used for mixing.

In another embodiment of the invention, the components are mixed immediately after extrusion.

In another advantageous embodiment, an additional component (C) may be added during mixing.

Any isocyanate suitable for the production of adhesives may be used as the first component A. In one particular embodiment, this component is a mono- or polyfunctional or blocked isocyanate.

The second component B may be selected from any available

formulations known per se. In one particular embodiment, component B is a substance containing at least two functional groups reactive to isocyanate groups, more particularly a polyol. Modifications of the second component may also be used to achieve corresponding properties, for example thixotropy, foaming, accelerated hardening, etc., of the final adhesives.

The quantity ratio between components A and B should preferably be selected so that either an excess of isocyanate groups is present or equivalent ratios are present. The excess of isocyanate groups can react with moisture.

The additional component C already mentioned may be used as another option for special applications. In one embodiment, the additional component (C) is an accelerator, a thixotropicizing agent, a foam-generating additive, a stabilizer, a dye and/or pigment and/or a molecular sieve for binding residual water.

In another embodiment, the additional component is added right at the beginning of the mixing of the first and second components.

In another advantageous embodiment, the components to be mixed are heated during mixing to enable the temperature of the adhesive produced to be adjusted as required without having to resort to the drive energy of the extruder for heating.

Finally, in another favorable embodiment, the adhesive is applied to the substrate to be bonded immediately after production either directly or by means of an application system known per se, optionally with a dosing unit in between. Relevant examples are discussed in detail in the following.

The present invention also relates to a machine for the continuous production of polyurethane hotmelt adhesives from a first component and at least a second component comprising at least one extruder and a mixer connected thereto. This machine is already known from the Düspohl prospectus cited above.

The solution to the problem stated above is characterized in that separate extruders are provided for the first and second components and in that the outlets of the extruders are connected to the inlet of the mixer.

In one preferred embodiment, the extruders are heatable.

In another advantageous embodiment, the mixer is a static mixer and, more particularly, is heatable.

Further advantageous embodiments can be found in the other subsidiary claims relating to the machine according to the invention.

Examples of embodiment of the invention are described in detail in the following with reference to the acompanying drawings, wherein:

Figure 1 shows a machine according to the invention connected to an adhesive gun.

Figure 2 is a longitudinal section through the static mixer used in the machine shown in Fig. 1.

Figure 3 shows a machine corresponding to Fig. 1 connected to a slot-like adhesive coating unit.

Figure 4 shows a machine corresponding to Fig. 1 with an additional adhesive dosing station.

In all the drawings, the same reference numerals have the same meanings and, accordingly, may only be explained once.

The machine shown in Fig. 1 comprises an extruder 1 with a drive 3 for component A (isocyanate), an extruder 2 with a drive 4 for component B, a static mixer 5, a feeder (not shown) for delivering component C to the mixer 5 and a control unit - again not shown. The temperature of the adhesive or the components and the rotational speeds of the extruders are controlled and displayed by the control unit. Components A and B are delivered from the outlets of the extruders 1 and 2 through heated pipes 6 to the corresponding inlets of the static mixer 5. Shutoff valves in the pipes 6 may be used for cleaning the machine. The valves 7 may be manually or pneumatically operated.

Components A and B are delivered to the respective extruders 1, 2 from feep hoppers 8. The extruders 1, 2 are heatable.

In the machine shown in Fig. 1, the static mixer 5 is directly connected to an adhesive application gun 9 known per se. Here, the final adhesive may either be removed in the form of drops (granules) or directly applied to the substrate to be bonded or delivered to an adhesive application roller connected to the application gun.

Figure 2 is a longitudinal section through the static mixer 5 which is continuously heatable and comprises a temperature control. The housing consists of a steel tube 10 provided on its inside with an anti-adhesion coating. The mixing element 11, the so-called internals, is provided with the same coating or with a corresponding coating. The mixing element 11 may consist, for example, of plastic (polyaramide), ceramic or steel.

The static mixer 5 enables component A to be mixed with component B to obtain a homogeneous end product. The physical properties of the end product may be influenced by addition of a component C. The mixing element 11 can be removed and replaced easily, quickly and conveniently for cleaning purposes. To this end, the steel tube 10 is provided at its lower end (in Fig. 2) with a screwed-in closure 12.

Figure 3 shows a machine similar to that illustrated in Fig. 1. In Fig. 3, however, the mixer 5 is connected to an adhesive application unit 13 with a slot nozzle. This variant is of advantage when the adhesive does have to be applied in exact amounts.

Finally, Fig. 4 shows a system similar to that illustrated in Figs. 1 and 3. In Fig. 4, however, the static mixer 5 is connected to a gear pump dosing station 14 by which the quantities of adhesive to be applied can be exactly measured. The adhesive issues from the nozzle 15.

The end products to be processed are moisture-curing polyurethane adhesives which, in addition, may be specially modified. For example, they

can be quick-curing, thixotropicizing and/or foaming. Preferred applications for these adhesives include, for example, surface lamination of various substrates, sandwich elements, caravan construction, garage door assembly, mobile home construction, sheathing of wide-section profiles (for example continuous manufacture of doors), three-dimensional lamination and the like.

List of reference numerals:

1	extruder
2	extruder
3	drive
4	drive
5	mixer
6	pipe
7	shutoff valve
8	feed hopper
9	adhesive application gun
10	steel tube
11	mixing element
12	closure
13	adhesive applicator
14	dosing gear pump station
15	nozzle

A	first component
B	second component
C	additional component

CLAIMS

1. A process for the production, more particularly the continuous production, of polyurethane hotmelt adhesives from an isocyanate (first component A) and at least a second component (B) known per se, characterized in that the two components (A,B) are dosed and transported, preferably extruded, and melted, more particularly at the same time, separately from one another and only then are mixed and allowed to react.

2. A process as claimed in claim 1, characterized in that the components (A, B) are additionally heated during extrusion.

3. A process as claimed in any of the preceding claims, characterized in that a static mixer is used for mixing.

4. A process as claimed in any of the preceding claims, characterized in that the components (A, B) are mixed immediately after extrusion.

5. A process as claimed in any of the preceding claims, characterized in that an additional component (C) is added during mixing.

6. A process as claimed in any of the preceding claims, characterized in that the first component (A) is a mono- or polyfunctional or blocked isocyanate.

7. A process as claimed in any of the preceding claims, characterized in that the second component (B) is a substance containing at least two functional groups reactive to isocyanate groups, more particularly a polyol.

8. A process as claimed in any of claims 5 to 7, characterized in that the additional component (C) is an accelerator, a thixotropicizing agent, a foam-generating additive, a stabilizer, a dye and/or pigment and/or a molecular sieve for binding residual water.

9. A process as claimed in any of claims 5 to 8, characterized in that the additional component (C) is added right at the beginning of the mixing of the first component (A) and second component (B).

10. A process as claimed in any of the preceding claims, characterized in that the components to be mixed are heated during mixing.

11. A process as claimed in any of the preceding claims, characterized in that the adhesive is applied to the substrate to be bonded immediately after production either directly or by means of an application system known per se, optionally with a dosing unit in between.

12. A machine for the continuous production of polyurethane hotmelt adhesives from a first component (A) and at least a second component (B) comprising at least one extruder (1, 2) and a mixer (5) connected thereto, characterized in that separate extruders (1, 2) are provided for the first and second components (A, B) and in that the outlets of the extruders (1,2) are connected to the inlet of the mixer (5).

Method and System for the Production of Polyurethane Hot-melt Type Adhesives

This invention relates to a process for the production, more particularly the continuous production, of polyurethane hotmelt adhesives from an isocyanate (first component A) and at least a second component B known per se.

Hotmelt adhesives, also known as hotmelts, are based inter alia on polyurethanes, are applied in the molten state and set particularly quickly on subsequent cooling. Polyurethanes are adhesive systems specifically composed of polyetherdiols/polyester diols (component B) and diisocyanates. The highly variable hardening of polyurethane adhesives is attributable to a second diol component or to atmospheric moisture. Polyurethanes form high-strength, elastic bonds which are capable of withstanding dynamic loads and changes in temperature.

The process mentioned above is known from a prospectus of Reinhard Düspohl Maschinenbau GmbH which describes a process for the production and immediate application of polyurethane hotmelt adhesives. Granules of the two components A and B are delivered to a mixing zone from two separate hoppers by separately driven metering screws. From the mixing zone, the granules pass into an extruder where they are heated to softening point by compression and frictional heat and processed to a homogeneous adhesive composition. The extruder may be followed by application systems for hotmelt adhesive.

However, depite its undoubted advantages, this process is also attended by a number of disadvantages. The melting temperature is applied solely by the drive energy of the extruder. Accordingly, subsequent heating or cooling is necessary in order to obtain the required processing temperatures and viscosities. To this end, the adhesive has to be brought

to the processing temperature in intermediate tanks which have to be blanketed with inert gas to prevent premature hardening of the adhesive. The cleaning of the intermediate tank with a special cleaner is another disadvantage.

After each stoppage, the machine, more particularly the extruder, has to be cleaned. The isocyanate constituents present in the machine have to be completely neutralized, i.e. reacted off, and removed.

Any water present in component B leads to a chemical reaction with the isocyanate during which carbon dioxide is formed and leads to foaming. In addition, amines by which crosslinking of the adhesive is accelerated, possibly undesirably, are also formed.

Further disadvantages include the high energy costs and the significant losses of adhesive used to "rinse" the machine and the relatively long dwell times of the adhesive mixtures at elevated temperatures. The relatively large amount of adhesive in the machine is also unfavorable. In addition, modified adhesive systems, for example accelerated, thixotropicizing or foaming systems, can only be produced and processed to a limited extent, if at all.

Accordingly, the problem addressed by the present invention was to avoid the above-mentioned disadvantages in the process mentioned at the beginning.

According to the invention, the solution to this problem for the process mentioned at the beginning is characterized in that the two components (A,B) are dosed and transported, preferably extruded, and melted, more particularly at the same time, separately from one another and only then are mixed and allowed to react.

In this way, improved temperature control is achieved during the melting of components A and B in the separate extruders.

The already melted components A and B can be mixed considerably more effectively. There is no longer any need for an intermediate tank to

bring the adhesive mixture to the required processing temperature. No adhesive at all is present in the extruders, only the components required for producing the adhesive. These components only react with one another in the mixer. There is no need to use inert gas. In the event of an interruption in the process, only the mixer and not the extruder need be cleaned, resulting in smaller losses of adhesive than in the prior art. Should the adhesive harden in the machine, only the mixer and not the extruder(s) need be replaced so that the break in operation is minor compared with the known process. Considerably smaller quantities of prepared adhesive are present in the machine and the exposure of the adhesive to heat before it is processed is considerably less. Relatively constant viscosities and consistencies are achieved. Finally, modified adhesive systems in particular, for example non-accelerated to highly accelerated, non-foaming to high-foaming and/or non-thixotropicizing to highly thixotropicizing systems, can also be produced. Another advantage is that water present in component B evaporates before this component comes into contact with the isocyanate.

In another embodiment of the invention, the components (A,B) are additionally heated during extrusion to enable the desired adhesive temperature to be adjusted as required.

In one advantageous embodiment of the invention, a static mixer is used for mixing.

In another embodiment of the invention, the components are mixed immediately after extrusion.

In another advantageous embodiment, an additional component (C) may be added during mixing.

Any isocyanate suitable for the production of adhesives may be used as the first component A. In one particular embodiment, this component is a mono- or polyfunctional or blocked isocyanate.

The second component B may be selected from any available

formulations known per se. In one particular embodiment, component B is a substance containing at least two functional groups reactive to isocyanate groups, more particularly a polyol. Modifications of the second component may also be used to achieve corresponding properties, for example thixotropy, foaming, accelerated hardening, etc., of the final adhesives.

The quantity ratio between components A and B should preferably be selected so that either an excess of isocyanate groups is present or equivalent ratios are present. The excess of isocyanate groups can react with moisture.

The additional component C already mentioned may be used as another option for special applications. In one embodiment, the additional component (C) is an accelerator, a thixotropicizing agent, a foam-generating additive, a stabilizer, a dye and/or pigment and/or a molecular sieve for binding residual water.

In another embodiment, the additional component is added right at the beginning of the mixing of the first and second components.

In another advantageous embodiment, the components to be mixed are heated during mixing to enable the temperature of the adhesive produced to be adjusted as required without having to resort to the drive energy of the extruder for heating.

Finally, in another favorable embodiment, the adhesive is applied to the substrate to be bonded immediately after production either directly or by means of an application system known per se, optionally with a dosing unit in between. Relevant examples are discussed in detail in the following.

The present invention also relates to a machine for the continuous production of polyurethane hotmelt adhesives from a first component and at least a second component comprising at least one extruder and a mixer connected thereto. This machine is already known from the Düspohl prospectus cited above.

The solution to the problem stated above is characterized in that separate extruders are provided for the first and second components and in that the outlets of the extruders are connected to the inlet of the mixer.

In one preferred embodiment, the extruders are heatable.

In another advantageous embodiment, the mixer is a static mixer and, more particularly, is heatable.

Further advantageous embodiments can be found in the other subsidiary claims relating to the machine according to the invention.

Examples of embodiment of the invention are described in detail in the following with reference to the acompanying drawings, wherein:

Figure 1 shows a machine according to the invention connected to an adhesive gun.

Figure 2 is a longitudinal section through the static mixer used in the machine shown in Fig. 1.

Figure 3 shows a machine corresponding to Fig. 1 connected to a slot-like adhesive coating unit.

Figure 4 shows a machine corresponding to Fig. 1 with an additional adhesive dosing station.

In all the drawings, the same reference numerals have the same meanings and, accordingly, may only be explained once.

The machine shown in Fig. 1 comprises an extruder 1 with a drive 3 for component A (isocyanate), an extruder 2 with a drive 4 for component B, a static mixer 5, a feeder (not shown) for delivering component C to the mixer 5 and a control unit - again not shown. The temperature of the adhesive or the components and the rotational speeds of the extruders are controlled and displayed by the control unit. Components A and B are delivered from the outlets of the extruders 1 and 2 through heated pipes 6 to the corresponding inlets of the static mixer 5. Shutoff valves in the pipes 6 may be used for cleaning the machine. The valves 7 may be manually or pneumatically operated.

Components A and B are delivered to the respective extruders 1, 2 from feep hoppers 8. The extruders 1, 2 are heatable.

In the machine shown in Fig. 1, the static mixer 5 is directly connected to an adhesive application gun 9 known per se. Here, the final adhesive may either be removed in the form of drops (granules) or directly applied to the substrate to be bonded or delivered to an adhesive application roller connected to the application gun.

Figure 2 is a longitudinal section through the static mixer 5 which is continuously heatable and comprises a temperature control. The housing consists of a steel tube 10 provided on its inside with an anti-adhesion coating. The mixing element 11, the so-called internals, is provided with the same coating or with a corresponding coating. The mixing element 11 may consist, for example, of plastic (polyaramide), ceramic or steel.

The static mixer 5 enables component A to be mixed with component B to obtain a homogeneous end product. The physical properties of the end product may be influenced by addition of a component C. The mixing element 11 can be removed and replaced easily, quickly and conveniently for cleaning purposes. To this end, the steel tube 10 is provided at its lower end (in Fig. 2) with a screwed-in closure 12.

Figure 3 shows a machine similar to that illustrated in Fig. 1. In Fig. 3, however, the mixer 5 is connected to an adhesive application unit 13 with a slot nozzle. This variant is of advantage when the adhesive does have to be applied in exact amounts.

Finally, Fig. 4 shows a system similar to that illustrated in Figs. 1 and 3. In Fig. 4, however, the static mixer 5 is connected to a gear pump dosing station 14 by which the quantities of adhesive to be applied can be exactly measured. The adhesive issues from the nozzle 15.

The end products to be processed are moisture-curing polyurethane adhesives which, in addition, may be specially modified. For example, they

can be quick-curing, thixotropicizing and/or foaming. Preferred applications for these adhesives include, for example, surface lamination of various substrates, sandwich elements, caravan construction, garage door assembly, mobile home construction, sheathing of wide-section profiles (for example continuous manufacture of doors), three-dimensional lamination and the like.

List of reference numerals:

1	extruder
2	extruder
3	drive
4	drive
5	mixer
6	pipe
7	shutoff valve
8	feed hopper
9	adhesive application gun
10	steel tube
11	mixing element
12	closure
13	adhesive applicator
14	dosing gear pump station
15	nozzle

A	first component
B	second component
C	additional component

CLAIMS

1. A process for the production, more particularly the continuous production, of polyurethane hotmelt adhesives from an isocyanate (first component A) and at least a second component (B) known per se, characterized in that the two components (A,B) are dosed and transported, preferably extruded, and melted, more particularly at the same time, separately from one another and only then are mixed and allowed to react.

2. A process as claimed in claim 1, characterized in that the components (A, B) are additionally heated during extrusion.

3. A process as claimed in any of the preceding claims, characterized in that a static mixer is used for mixing.

4. A process as claimed in any of the preceding claims, characterized in that the components (A, B) are mixed immediately after extrusion.

5. A process as claimed in any of the preceding claims, characterized in that an additional component (C) is added during mixing.

6. A process as claimed in any of the preceding claims, characterized in that the first component (A) is a mono- or polyfunctional or blocked isocyanate.

7. A process as claimed in any of the preceding claims, characterized in that the second component (B) is a substance containing at least two functional groups reactive to isocyanate groups, more particularly a polyol.

8. A process as claimed in any of claims 5 to 7, characterized in that the additional component (C) is an accelerator, a thixotropicizing agent, a foam-generating additive, a stabilizer, a dye and/or pigment and/or a molecular sieve for binding residual water.

9. A process as claimed in any of claims 5 to 8, characterized in that the additional component (C) is added right at the beginning of the mixing of the first component (A) and second component (B).

10. A process as claimed in any of the preceding claims, characterized in that the components to be mixed are heated during mixing.

11. A process as claimed in any of the preceding claims, characterized in that the adhesive is applied to the substrate to be bonded immediately after production either directly or by means of an application system known per se, optionally with a dosing unit in between.

12. A machine for the continuous production of polyurethane hotmelt adhesives from a first component (A) and at least a second component (B) comprising at least one extruder (1, 2) and a mixer (5) connected thereto, characterized in that separate extruders (1, 2) are provided for the first and second components (A, B) and in that the outlets of the extruders (1,2) are connected to the inlet of the mixer (5).

13. A machine as claimed in claim 12, characterized in that the extruders (1,2) are heatable.

14. A machine as claimed in claim 12 or 13, characterized in that the mixer is a static mixer and, more particularly, is heatable.

15. A machine as claimed in claim 12 or 14, characterized in that the outlets of the extruders (1,2) are connected directly or by heated pipes (6) to the inlet of the static mixer (5).

16. A machine as claimed in claim 12 or 15, characterized in that the mixer (5) has an additional inlet for the introduction of an additional component (C).

17. A machine as claimed in the previous claim, characterized in that the additional inlet is arranged near the inlets for the first two components (A,B).

18. A machine as claimed in claim 12 or 17, characterized in that the outlet of the mixer (5) is connected to the inlet of an adhesives application unit (9,13), if possible through a dosing apparatus (14).

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

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199 29 820.3 1. Juli 1999 (01.07.1999) DE

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(84) Bestimmungsstaaten *(regional)*: europäisches Patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

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— *Mit internationalem Recherchenbericht.*
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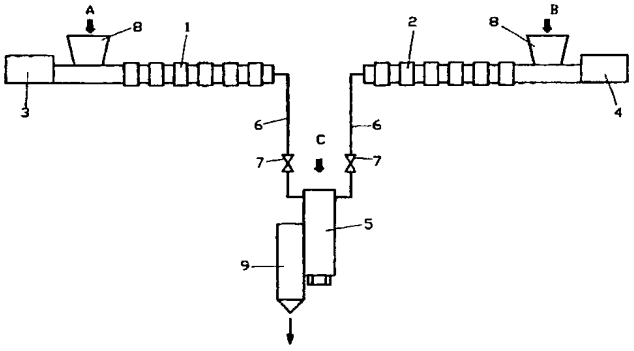
Zur Erklärung der Zweibuchstaben-Codes, und der anderen Abkürzungen wird auf die Erklärungen ("Guidance Notes on Codes and Abbreviations") am Anfang jeder regularen Ausgabe der PCT-Gazette verwiesen.

(54) **Title:** METHOD AND SYSTEM FOR THE PRODUCTION OF POLYURETHANE HOT-MELT TYPE ADHESIVES

(54) **Bezeichnung:** VERFAHREN UND ANLAGE ZUM HERSTELLEN VON POLYURETHAN-SCHMELZKLEBSTOFFEN



(57) **Abstract:** Polyurethane hot-melt type adhesives are produced from an isocyanate (first constituent A) and at least one second consitutent (B) known per se. Both constituents (A, B) are extruded separately and melted, whereupon they are mixed and reacted with each other. The invention provides a plurality of advantages over prior art.

(57) **Zusammenfassung:** Polyurethan-Schmelzklebstoffe werden aus einem Isocyanat (erste Komponente A) und mindestens einer zweiten, an sich bekannten Komponente (B) hergestellt. Man extrudiert beide Komponenten (A, B) getrennt voneinander, schmilzt diese auf und mischt sie erst dann und läßt sie reagieren. Eine Vielzahl von Vorteilen gegenüber dem Stand der Technik wird erreicht.

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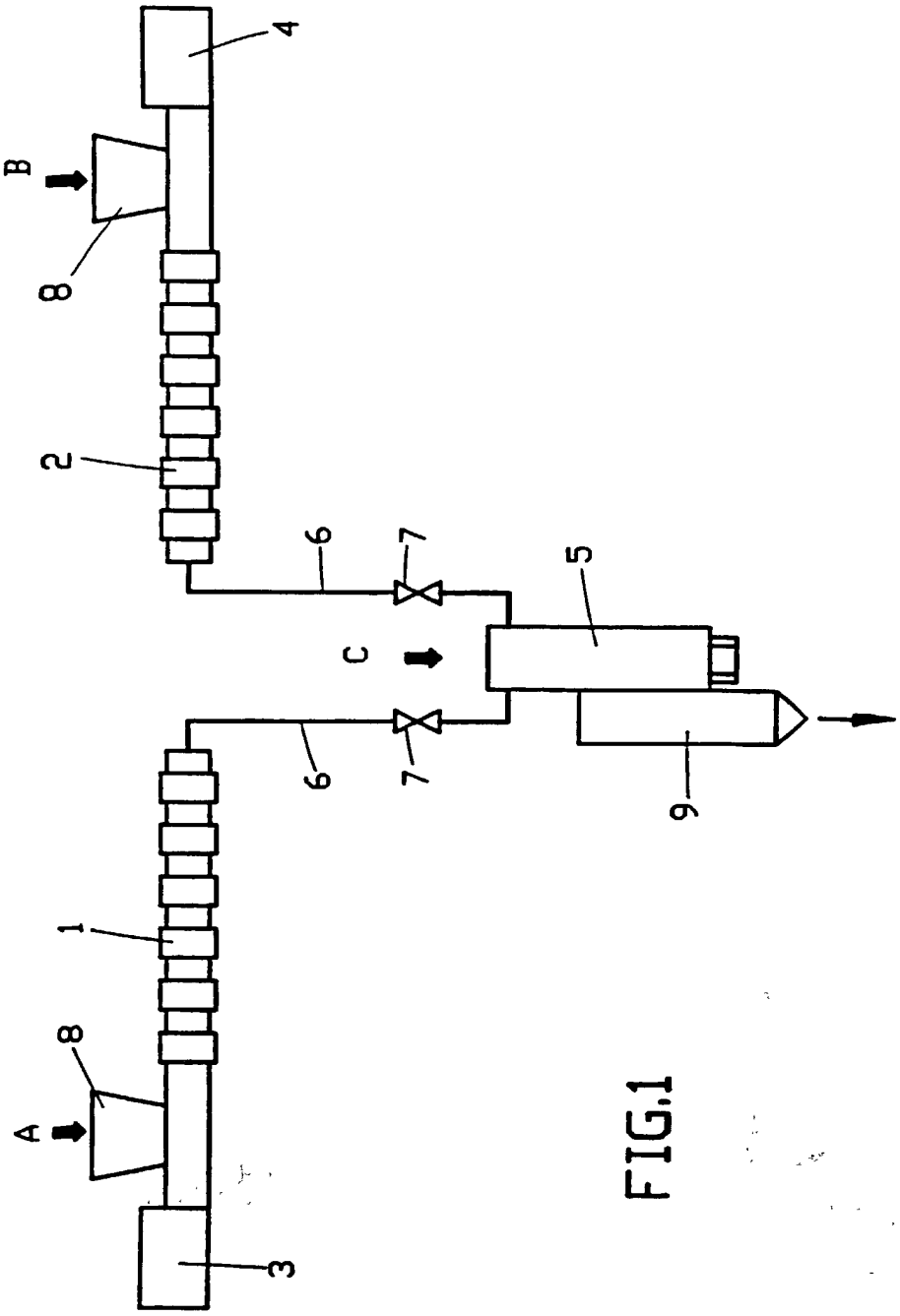

FIG.1

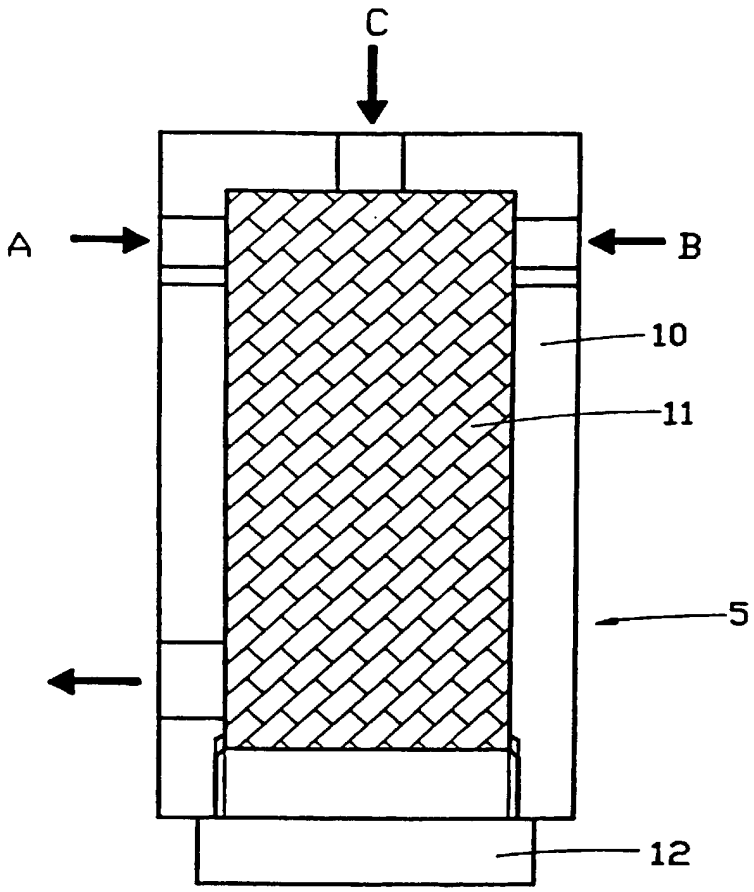

FIG.2

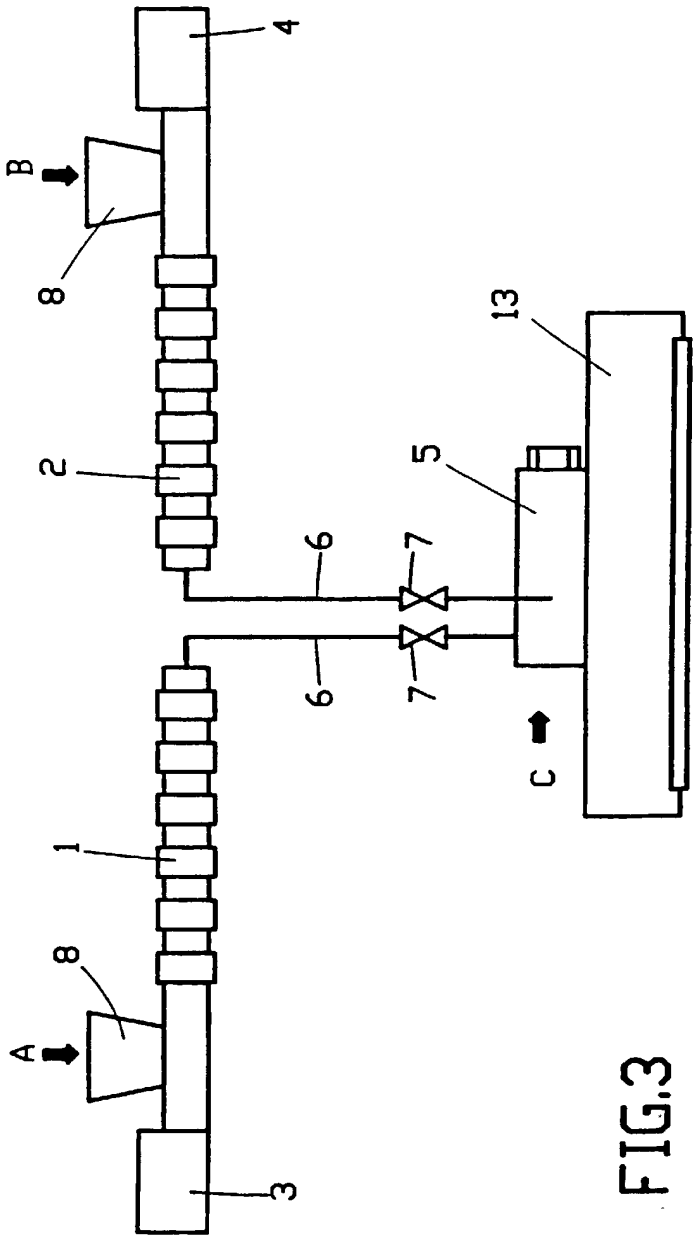

FIG.3

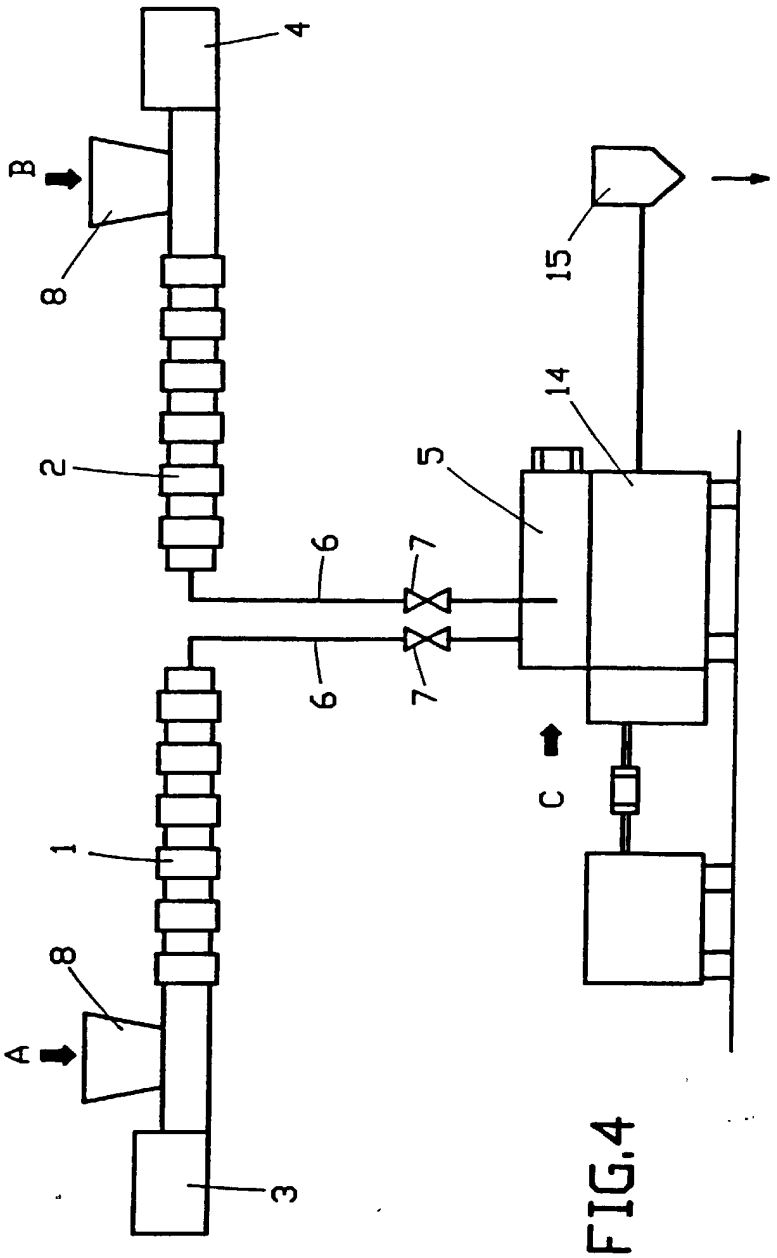

FIG.4

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DECLARATION

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U.S. Parent Application Number	PCT Parent Number	Parent Filing Date (MM/DD/YYYY)	Parent Patent Number *(if applicable)*
	PCT/EP00/05805	6/23/2000	

☐ Additional U.S. or PCT international application numbers are listed on a supplemental priority sheet attached hereto.

As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

☐ Firm Name OR ____ Customer Number ____ or label ____

☒ List Attorney(s) and/or agent(s) name and registration number below:

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Name of Sole or First Inventor: ☐ A petition has been filed for this unsigned inventor

Given Name	**Hans-Peter**	Middle Initial		Family Name	**KOHLSTADT**	Suffix e.g. Jr.	
Inventor's Signature	H. P. Kohlstadt					Date	23.02.2002
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Applicant Authority							

☒ Additional inventors are being named on supplemental sheet(s) attached hereto

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DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION

☐ Declaration Submitted with Initial Filing OR ☒ Declaration Submitted after Initial Filing

Attorney Docket Number	H 4186 PCT/US
First Named Inventor	KOHLSTADT, Hans-Peter
COMPLETE IF KNOWN	
Application Number	10/030,267
Filing Date	
Group Art Unit	
Examiner Name	

As a below named inventor, I hereby declare that:
My residence, post office address, and citizenship are as stated below next to my name.
I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

METHOD AND SYSTEM FOR THE PRODUCTION OF POLYURETHANE HOT-MELT TYPE ADHESIVES

(Title of the Invention)

the specification of which

☐ is attached hereto

OR

☒ was filed on (MM/DD/YYYY) 6/23/2000 as United States Application Number or PCT International Application Number PCT/EP00/05805 and was amended on (MM/DD/YYYY) _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37 Code of Federal Regulations, § 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code §119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT International application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or of any PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached? YES	Certified Copy Attached? NO
199 29 820.3	Germany	7/1/1999	☐	☐	☒

☐ Additional foreign application numbers are listed on a supplemental priority sheet attached hereto:

I hereby claim the benefit under Title 35, United States Code §119(e) of any United States provisional application(s) listed below.

Application Number(s)	Filing Date (MM/DD/YYYY)	Additional provisional application numbers are listed on a supplemental priority sheet attached hereto.
		☐

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DECLARATION

ADDITIONAL INVENTOR(S) Supplemental Sheet

1-00

Name of Additional Joint Inventor, if any:						☐ A petition has been filed for this unsigned inventor		
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Post Office Address	Azaleenweg 28							
Post Office Address								
City	40670 Meerbusch	State		Zip		Country	Germany	Applicant Authority

Name of Additional Joint Inventor, if any:						☐ A petition has been filed for this unsigned inventor	
Given Name		Middle Initial		Family Name		Suffix e.g. Jr.	
Inventor's Signature					Date		
Residence: City		State		Country		Citizenship	
Post Office Address							
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Given Name		Middle Initial		Family Name		Suffix e.g. Jr.	
Inventor's Signature					Date		
Residence: City		State		Country		Citizenship	
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DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION

☐ Declaration Submitted with Initial Filing OR ☒ Declaration Submitted after Initial Filing

Attorney Docket Number	H 4186 PCT/US
First Named Inventor	KOHLSTADT, Hans-Peter
COMPLETE IF KNOWN	
Application Number	10/030,267
Filing Date	
Group Art Unit	
Examiner Name	

As a below named inventor, I hereby declare that:
My residence, post office address, and citizenship are as stated below next to my name.
I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

METHOD AND SYSTEM FOR THE PRODUCTION OF POLYURETHANE HOT-MELT TYPE ADHESIVES

(Title of the Invention)

the specification of which

☐ is attached hereto

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I acknowledge the duty to disclose information which is material to patentability as defined in Title 37 Code of Federal Regulations, § 1.56.

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199 29 820.3	Germany	7/1/1999	☐	☐	☒

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DECLARATION

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I hereby claim the benefit under Title 35, United States Code §120 of any United States application(s), or §365© of any PCT international application designating the United Sates of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT international application in the manner provided by the first paragraph of Title 35, United States Code §112.1 acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. Parent Application Number	PCT Parent Number	Parent Filing Date (MM/DD/YYYY)	Parent Patent Number *(if applicable)*
	PCT/EP00/05805	6/23/2000	

☐ Additional U.S. or PCT international application numbers are listed on a supplemental priority sheet attached hereto.

As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

☐ Firm Name OR ☐ Customer Number or label

☒ List Attorney(s) and/or agent(s) name and registration number below:

Name	Registration Number	Name	Registration Number
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Glenn E. J. Murphy	33,539		
Stephen D. Harper	33,243		
Kimberly R. Hild	39,224		

☐ Additional attorney(s) and/or agent(s) named on a supplemental sheet attached hereto.

Please direct all correspondence to: ☒ Customer Number or label **00423** OR ☐ Fill in correspondence address below

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Name of Sole or First Inventor: ☐ A petition has been filed for this unsigned inventor

Given Name	**Hans-Peter**	Middle Initial		Family Name	**KOHLSTADT**	Suffix e.g. Jr.	
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☒ Additional inventors are being named on supplemental sheet(s) attached hereto

(+) inside this box →

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DECLARATION

ADDITIONAL INVENTOR(S)
Supplemental Sheet

Name of Additional Joint Inventor, if any:		☐ A petition has been filed for this unsigned inventor					
Given Name	Andrew	Middle Initial		Family Name	NIXON	Suffix e.g. Jr.	
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Name of Additional Joint Inventor, if any:		☐ A petition has been filed for this unsigned inventor					
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Applicant Authority							

Name of Additional Joint Inventor, if any:		☐ A petition has been filed for this unsigned inventor					
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Applicant Authority							

Name of Additional Joint Inventor, if any:		☐ A petition has been filed for this unsigned inventor					
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City		State		Zip		Country	
Applicant Authority							

☐ Additional inventors are being named on supplemental sheet(s) attached hereto